A Question of Control:
The Nature of the Relationship Between Mapping for Land Surveying and Cadastral Purposes in Santa Barbara County

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Owing to its source and presentation, governmental geographic information may appear to be authoritative and to be positionally accurate. However, users should recognize the associated disclaimers and consider the various methodologies used for creating the data, as well as review the metadata entries for purpose, use constraints, and positional accuracy.

At the local level, parcel maps primarily support local property taxation. However, they may have varied levels of position accuracy. Likewise, most Santa Barbara County Surveyor GIS data is not in true spatial position, but is created to provide a spatial index for land survey records research.

An ideal Land Information System (LIS) would contain cadastral data that is not just referential but that represents information from field-survey collected, high quality GPS observations tied to control points. This presentation examines the history and status of Santa Barbara County’s land survey and tax parcel GIS data.
County Surveyor Duties

**California Government Code**

**27556.** The surveyor shall copy, plat, or trace each map filed for record in the office of the county recorder, at the cost of the party filing the map, and is ex officio deputy recorder for the county for such purposes. …

**27557.** The surveyor shall plat, trace, blueprint, or otherwise make all county, road, district, and other maps and, at the request of the assessor, make all assessors' block-books for the county.

**Professional Land Surveyor’s Act**

**8773.2.** Corner record filing. (e) A charge for examining, indexing, and filing the corner record may be collected by the county surveyor, not to exceed the amount required for the recording of a deed.

**8774.5.** County Surveyor, Index. (a) Upon the filing of a record of survey, amended record of survey, or certificate of correction for recordation pursuant to this chapter, the surveyor or engineer who prepared the document shall transmit a copy of the document, including all recording information, to the county surveyor, who shall maintain an index, by geographic location, of the documents.
County Assessor Duties

**California Government Code, section 27421:** “The county assessor in each county who is designated to perform the duty of assessing property for a local taxing jurisdiction shall, upon request of the governing body of such jurisdiction, excluding a school district, furnish not later than May 15th of each year an estimate of the assessed valuation of property within such jurisdiction for the succeeding fiscal year.”
1895-1946. County Surveyors
1850-1959. County Surveyor

Manual, 18x26” Drafting

In 1850 Santa Barbara County was one of the 26 original counties in California. In 1895, Frank F. Flournoy became the County Surveyor. In 1915, Owen Hugh O’Neill, PLS 845, was elected as County Surveyor. Until 1960, the County Surveyor was responsible for making assessors' block-books. The assessor’s mapping group has a complete microfilm set of these historic Assessment maps from 1928-1962. A paper book index relates the pre-1960 series to the current series.

The historic maps measure 18x26”. These maps are identified by a code, for example 7-D-15. The first number is a code for an area and the last numbers are sheet numbers. The maps were revised about every 4 years, so there are sets for 1928, 1932, 1936, 1940, etc. Each map also has property transfer and assessment data for the period covered on microfilm in a card file. Each microfilm has 2-4 maps sheets and 2-4 ledger sheets on it. These maps were often used as base maps for other county maps at that time such as school and other districts.

City Assessment Maps from the same time period are also on microfilm. They follow the same format as the unincorporated area maps and ledgers, except they were mapped on 11x17” sheets.

In 1946, Wallace C. Penfield, RCE 3162, was appointed as County Surveyor. Later in 1946, Francis E. Evans, PLS 1824 was appointed County Surveyor by the Board of Supervisors. Penfield & Smith was founded by Penfield and Delbert D. Smith that same year.

-Emails to the author, Duane Gower and Mike Collie, 5/17/2010
1928-1959. County Surveyor, Assessor’s Block-Books

Manual, 18x26” Drafting
1928-1959. County Surveyor, Assessor’s Block-Books

Packard Addition to the City of Santa Barbara, edited 5-25-1950
1960-1991. County Assessor’s Block-Books

Manual, 11x17” Drafting

The current series of Assessor’s maps was mandated by the state about 1960, and was changed to an 11x17” format. Francis E. Evans was the County Surveyor when the parcel mapping function went from the County Surveyor’s Office to the County Assessor’s office. Government code section 27557 states that the County Surveyor will make Assessor’s block-books at the request of the Assessor.

The Assessor’s Office mapping section honors tax and election regulations and must have control over the timing of the changes to the cadastre and election precincts. There is a basic mapping manual, Assessors' Handbook Section 215 manual re-revised in April 2010 as Assessment Standards for Manual Systems issued by the State Board of Equalization that specifies standards for county tax mapping.
1960-1991. County Assessor’s Block-Books

The 11x17” format began in 1960. Current page shown for APN 111-231-004

GIS Heads-Up Digitization

Kenneth A. Pettit was the County Assessor in 1996. “The GIS parcel base was created over a period of 30 months during 1996, 1997 and 1998 by four individuals.” They were Philip Packard, Chief Mapping Technician; Dennis Loyst, Mapping Technician II; Jared Dawson, Mapping Technician II and Michelle Nyman, Mapping Technician I.

“They first scanned the 4300-4400 Assessor maps at approximately 300 DPI, which were mapped at various scales from 1:20 to 1:1200. The scanned maps were then digitized using ‘heads-up’ techniques. AutoCAD had been used in the department since 1992, and this tool was used to create accurate topology once all individual Assessor maps were ‘fit’ together. Staff ensured that no gaps or overlaps existed and every parcel had a unique APN.”


Sources Used for GIS Control

“More accurate basemaps were integrated into the County basemap from surrounding organizations. These sources included the City of Santa Barbara (Penfield and Smith), the Goleta Sanitary District and the City of Lompoc…. Later on, the base map was compared with a GPS street centerline produced by Knopf. This source, along with subsequent aerial imagery produced by AirPhoto USA, was used to ensure that parcels were in the correct general location.

Overall, positional accuracy of the parcel database was assumed to be as good as the Knopf street GPS centerlines and United States Geological Survey (USGS) quadrangle maps in areas outside of the cities of Santa Barbara, Goleta, and Lompoc. Public Works Flood Control aerial/topographical projects of the early 1990s were also used for registration of the other urban-rural areas. All sources were projected into NAD83, State Plane, Zone 5, US Foot. Within the cities of Santa Barbara, Lompoc, Goleta, and urban areas surrounding Goleta, the accuracy of the basemap is considered to be approximately 2’ to 5’. This covers approximately 40% of the parcels. Wherever there are Knopf centerlines, positional accuracy is considered to be approximately 3’ to 10’. This covers an additional 45% of the parcels. Where there was registration to Flood Control topographic data, accuracy is approximately 5’ to 15’. This covers an additional 10% of parcels. In the remaining, rural areas where USGS quads were used, accuracy is approximately 15’ to 100.’”

-County of Santa Barbara Land Information Workflow Study, Dawn Robbins, 8/2007

Entire parcel layer in GIS (2012 data shown)

Detail of parcel layer in GIS (2012 data shown)

Sources Used for GIS Control in 1998

- First estimate is from *County of Santa Barbara Land Information Workflow Study*, Dawn Robbins, 8/2007. Second estimate is from Records of Surveys Metadata, 2012.

- **Cities, 2-5'**: 10%
- **Centerlines, 3-10'**: 40%
- **Topos, 5-15' or 3-6'**: 45%
- **Quads, 15-100' or 100-200'**: 10%

GIS for District Mapping

Edmund R. Villa, PLS 6232, was the County Surveyor from 1994 to 1997. Christine B. Brooks, PLS 7227, helped establish horizontal control for GIS use.

In late 1997, Mike Emmons, PLS 5899, was appointed as County Surveyor by the Board of Supervisors. He was selected and recommended by Phil Demery, Public Works Director, specifically to design and implement a Public Works GIS. Emmons had extensive experience from his work in Orange County.

The County Assessor's Office had a parallel GIS program at that time and was named as the lead of the County GIS by the Board of Supervisors. There was a County GIS Committee consisting of the Assessor, Planning, Public Works and others. It was decided to use the assessors office parcel layer as GIS base data.

Funding for the Surveyor's Office GIS came from the CAO and LAFCO. Emmons hired Brenda Turner as a Mapping Technician in 1998 because she had mapping and boundary experience from working in Kern County. After hiring Turner, Emmons hired Zacharias Hunt from UCSB around 1999 for his GIS knowledge. Turner updated special district maps as required by law. Her workflow began in AutoCAD, then she exported as polygon shapefiles. This was the first modern GIS in the Surveyor's Office.

-Email to the author, Mike Emmons, 8/2012
In 2002, Joseph E. Holland was elected as the County Clerk, Recorder and Assessor. In 2007, Assessor staff included Jim McClure, Deputy Assessor; Chris Lyon, Operations Division Manager and Duane Gower, Interim Supervisor. There were about 4,300 individual maps showing geographically joined groups of parcels. “For the 2007 secured assessment roll, there are 127,329 individual Assessor parcels….The Assessor’s mapping staff is required to update the Assessor maps whenever ownership boundaries change, as in the case when…[an activity] is noted and recorded…. The net affect of these , and related activities, is the addition of 1000-1500 parcels per year, and approximately 3000 boundary changes. These parcels must be updated on Assessor maps, estimated by the mapping staff to be updates to approximately 320 maps per year…. Of the 4,300 Assessor Maps that comprise the County, approximately 15% have been fully drawn or redrawn using CoGo (coordinate Geometry) techniques using AutoCAD software. An additional 10% are considered hybrids where all the new parcels have been cogoed and the remaining parcels on the page are left in their raster format. The remaining 75% of the maps that were hand-drawn have not required revision because there has been no development affecting those parcels. All hand-drawn maps have been scanned, subsequently digitized and used to help create the original GIS base map.”

-County of Santa Barbara Land Information Workflow Study, Dawn Robbins, 8/2007
2000-2008. County Assessor GIS

Digital Assessor Map Formats

- 75% Raster
- 10% Hybrid
- 15% CoGo

2000-2008. County Assessor GIS

Parcel Creation and Editing Techniques

“CoGo techniques are always used in creating new parcels. If CoGo work is complete and Survey tolerances are not met in the recorded source, mapping staff rectify the problem by researching the conflicting survey data on surrounding properties. Differences can be dozens of feet on large properties. The Assessor staff has rectified these types of differences using existing and recorded information since the 1960’s…

On recorded maps, where accurate information is available, including coordinates, the information is used to improve the Basemap. Over the last five years, only 5-10 recorded maps have coordinates and ties to the California High Precision Geodetic Network, which provides real world coordinates. The cities of Santa Barbara and Lompoc provide maps with ties to their own or this network about 25% of the time. The CoGo’d attributes are saved in the individual AutoCAD files (one per Assessor map)….An updated CoGo’d parcel or group of parcels is converted to a shapefile….It is positioned and rectified with any non-coincident legal boundaries to the basemap.”

-County of Santa Barbara Land Information Workflow Study, Dawn Robbins, 8/2007
2000-2008. County Surveyor GIS

GIS Integration

Mike Emmons, County Surveyor, hired Teñell Matlovsky in 2001 for his 3D modeling, engineering, drafting, mapping, GIS, database, web design, and public sector experience. Matlovsky worked with the field survey operation to evolve the County’s data collection, processing, modeling, mapping and CAD engineering standards. The improved standards allowed the department more interoperability with GIS. In 2002, Emmons teamed up Hunt and Matlovsky, creating the Public Works GIS Technical Committee to coordinate spatial data needs for the department.
2000-2008. County Surveyor GIS

2/11/2000  Shapefile for a LAFCO district, the Cuyama Valley Recreation and Park District
2/19/2002  Shapefile for city LAFCO activity, City of Santa Maria.
5/13/2002  Corner Record shapefile from field project S447 in Isla Vista
2002      Formation of the Public Works Department GIS technical committee
10/19/2002 Started CoGoing land grants
2003      Survey Engineering Design CAD standards adopted by Public Works Department
Pre 11/2004 Records of Surveys and Intersections Ties have index shapefile
Pre 8/2005  Maps (Tracts) and Parcel (Subdivision) maps have index shapefile
2007      Started Condominium Plans and Certificate of Correction Index shapefile
2007      Started Special Districts GDB for LAFCO indexing and boundary compilation
2007      Teñell Matlovsky appointed as Public Works GIS Analyst and acting supervisor
11/26/2008 Posted Corner Records and Intersection Ties index shapefile on web site (Ektron)
12/1/2008  Posted Records of Surveys, Maps (Tracts), Parcel (Subdivision) Maps and Condominium Plans index shapefiles on web site (Ektron)
2000-2008. County Surveyor GIS

Indexing Corner Records
2000-2008. County Surveyor GIS

Street Centerlines and Survey GIS Data Accuracy

In 2005-2007, the Surveyor’s Office GIS section produced a “street centerline file created through the use of the most recent aerial imagery. The accuracy of this data has been determined to be 6’ to 8’ in urban areas where more control is present, and 8’ to 10’ where control is sparse.” This product was created for the Sheriffs dispatch system....

Survey mappers are capable of entering their data using highly accurate real-world coordinates and CoGo….When updates to the GIS parcel base are provided by the Assessor, the parcels position has shifted, resulting in misregistration of previously mapped reference polygons.

-County of Santa Barbara Land Information Workflow Study, Dawn Robbins, 8/2007, with comments from the Surveyor’s Office.

Not all source data use the California Coordinate System. Also, using and creating coordinate geometry can be time consuming. There is no policy or funding for survey grade control GIS data to snap to.
2000-2008. County Surveyor GIS

An example of a misregistered index polygon
**2008-2012. County Assessor, Current GIS**

County Assessor Throughput

As of 2009, An average of 60 documents are received daily thru the Maps Module. An average of 12 per day have Metes/Bounds or legal descriptions that are “missing, incomplete, or incorrect.” For the ones with legal descriptions “insufficient to identify the property adequately,” a letter is sent to the taxpayer or their representative with a general explanation in hope for a response with assistance.

-Santa Barbara County Assessor’s Office, Mapping/GIS Section, Powerpoint presentation, 8/2009

“Very few communities can afford the cost of compiling parcel data directly from the legal description on a deed because of the labor-intensive process of interpreting and resolving discrepancies in legal descriptions found on many deeds….In most jurisdictions, it is not legally required that the parcel descriptions in deeds be compiled and verified by a land surveyor. This often leads to legal descriptions that are unclear, are nearly impossible to locate, and contain geometry errors. This is a bigger problem than the technical issues, since most GISs contain the tools needed to perform the coordinate geometry computations. It may take field work or legal interpretations to resolve inconsistencies in legal descriptions in deeds.”

2008-2012. County Surveyor, Current GIS

12/8/2008 Adrian Foster hired as GIS Technician
2009 New revisions to maps of Cities and Special Districts
8/7/2009 Started Maps and Surveys index shapefile
11/30/2009 Developed Rights-of-Way index shapefile
4/15/2010 Deployment of Surveyor Information System Interactive Map
2011 1820 total actions counted for LAFCO special district and cities since 1855
2012 Mike Emmons Retires from Office of the County Surveyor
2012 Aleks Jevremovic, PLS 8378, appointed as County Surveyor by the Board of Supervisors
7/1/2012 Teñell Matlovsky, PLS 8629, appointed as Public Works Survey Supervisor
2012 Total index polygon count is 17,438 for recorded maps
2008-2012. County Surveyor, Current GIS

New revisions to maps of Cities and Special Districts
2008-2012. County Surveyor, Current GIS

Developed making shapefiles for Rights-of-Way for Flood Control and Transportation
2008-2012. County Surveyor, Current GIS

Deployed Surveyor Information System Interactive Map
County Surveyor GIS Purpose

Abstract: These polygons are a graphical representation for reference to maps recorded in Books of [book type], Records of Santa Barbara County, California.

Purpose: The data set was created to provide a spatial index for land survey records research.

Use constraints: While every effort has been made to ensure that this data is complete and reliable, the Office of the County Surveyor does not assume liability for any damages caused by any errors or omissions in the data, nor as a result of improper use of the dataset. The dataset is not intended to obtain coordinate values, distances or bearings.
County Assessor GIS Purpose

• “The principal business requirements for the local assessor and the state assessment agency are for (1) the more efficient property assessment for local assessors, and (2) the ability of the state to ensure that there is more efficient and equitable assessment of property values….

• It can be argued that in addition to the efficiencies that digital parcel data bring to the assessment community, the parcel layer used as a base map is the most information-rich database with the broadest utility to local, state, and federal agencies”

Quality of Data Existing in Digital Parcel Maps

“At the local level, parcel maps primarily support local property taxation and are usually adequate for that purpose. However, their underlying base maps can be many years old and they are often georeferenced incorrectly, do not align with high-resolution orthophotography, and may be internally inconsistent due to original source and methods used to create the data. Poor quality control, especially in terms of geographic accuracy, is understandable because of the cost of producing highly accurate data.”

County GIS without Control Points

GIS data from different sources is not registered. GIS control points are needed.
Data Standards for Control

GIS for the Nation includes Geodetic Control and Boundary Points
Data Standards for Control
GIS for the Nation and the FGDC

Geodetic Control: “Survey control network for local, regional and national geo-referencing. Cadastral data should be tied to geodetic control. Orthoimagery and LiDAR should be tied to the control. Geodetic control provides the basic reference for other data according to NGS specifications for identification and capture.”
- *GIS for the Nation Poster*

See also the FGDC *Cadastral Data Content Standard for the National Spatial Data Infrastructure*.

See also the FGDC *Geospatial Positioning Accuracy Standards*
Data Standards for Control

FGDC: Geodetic Control

*Federal Geographic Data Committee, Graphic Information Framework Data Content Standard Part 4: Geodetic Control*

“Geodetic control provides a common reference system for establishing the coordinate positions of all geographic data. It provides the means for tying all geographic features to common, nationally used horizontal and vertical coordinate systems.

Geodetic control information plays a crucial role in developing all framework data and users’ applications data, because it provides the spatial reference source to register all other spatial data.

Geodetic control surveys are performed to far more rigorous accuracy and quality assurance standards than those for local control surveys for general engineering, construction, or topographic mapping purposes.

Although this part does not encompass non-geodetic control points, such as Public Land Survey System points, local government control points, project control points for public and private projects, aerial-photo control points, and so on, it can be used as a model for other control points and coordinated points (see Annex D).”
Data Standards for Control

FGDC: Geodetic Control

*Federal Geographic Data Committee, Graphic Information Framework Data Content Standard Part 4: Geodetic Control.*
Annex D (informative) Control points and coordinated points

There are various categories of points that are described with coordinates. The most general category is coordinated points which can be any point on the ground or on a map for which coordinates have been determined. There are also many methods for determining the coordinates of these points. A subset category of coordinated points is control points. Control points have several common characteristics:

- They are physical points on the ground which can be revisited or located for future use
- They are used for subsequent projects, that is to say, they themselves are not the end product
- Their coordinates are determined using more accurate techniques because they will be used to control or fit future spatial data activities
Data Standards for Control

FGDC: Geodetic Control

*Federal Geographic Data Committee, Graphic Information Framework Data Content Standard Part 4: Geodetic Control.*

Annex D (informative) Control points and coordinated points

Geodetic control is one type or category of control points. This part can be expanded with additional elements to make it fit the more general class of control points. For example, one attribute that could be added is control point TYPES. Some examples of these TYPES are:

- **NSRS** – geodetic control points whose coordinates have been verified and placed in a national database
- **PLSS** – Public Land Survey System points whose coordinates have been determined
- **Property corner** – lot or property points, non-PLSS, whose coordinates have been determined
- **Photo control** – photographic identifiable points set for aerial photography whose coordinates have been determined
- **Right-of-way** – right-of-way points whose coordinates have been determined
- **Local control** – random control points whose coordinates have been determined that are not multi-functional (that is to say, established for a single use) and are not NSRS
Sources for Control Data

BLM LSIS

The GeoCommunicator Land Survey Information System or LSIS is the official federal government Web site for the distribution of the Public Land Survey System (PLSS) data to support the mapping of federal land parcels.

The Bureau of Land Management (BLM) Cadastral Survey Program is responsible for the official boundary surveys of all federal-interest lands in the United States, which is over 700 million acres, nationwide. The Public Land Survey System is the foundation for many survey-based geographic information systems.

-BLM. http://www.geocommunicator.gov/GeoComm/Isis_home/home/
Sources for Control Data

BLM California Public Land Survey Geodatabase
Sources for Control Data

Most recent County-wide control survey, from 2002
Sources for Control Data

Most recent County-wide control survey, from 2002

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Sources for Control Data

Geodetic Control-NGS Continuously Operating Reference Stations
Sources for Control Data

Geodetic Control-California Spatial Reference Network

CSRC - California Spatial Reference Network (CSRN)

CSRS Epoch 2011.00: ITRF2005 and NAD83(NSRS2007)
coordinates, velocities, and
uncertainties for 830 CGPS
sites in California and
border regions
Sources for Control Data

Aerial Photo Control-CIRGIS 2010 Imagery
### Sources for Control Data

Aerial Photo Control-CIRGIS 2010 Imagery

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Sources for Control Data

Topographic Survey - S167 Jalama Road Bridge 16
Includes State Plane coordinates, Surveyor’s Note, Basis of Bearings, and Grid to Ground Factors
Sources for Control Data

Topographic Survey - S167 Jalama Road Bridge 16
Includes State Plane coordinates, Surveyor’s Note, Basis of Bearings, and Grid to Ground Factors

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Sources for Control Data

Record of Survey with State Plane coordinates – RS6671 Rancho Los Alamos
## Sources for Control Data

Record of Survey with State Plane coordinates – RS6671 Rancho Los Alamos

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| MON07 | 2132858.56 | 5835784.91 | 948.17 | 0.999883273 | FOUND 1½" IRON PIPE OPEN, ON THE WES 
| LEN ON THE WESTERLY FACE OF 4X4 WOOD POST LEANING NO |
| MON08 | 2126508.64 | 5872769.35 | 961.73 | 0.999882829 | FOUND 3" IRON PIPE WITH 3" BRONZE CAP |
| MON09 | 2139715.76 | 5852054.35 | 981.29 | 0.999882218 | STAMPED "CC LOTS 2A-3 J COR SECS 31&36 T9N R32W A No. 6 J.D. MCGREGOR LICENSE 
| MON10 | 2129382.04 | 5830805.95 | 624.80 | 0.999883535 | LA14, FOUND 3½" BRASS CAP STAMPED "UNION OIL COMPANY OF CALIFORNIA LA14", IN |
| MON11 | 2140794.26 | 5848151.47 | 811.17 | 0.999890439 | FOUND 2" IRON PIPE WITH 3½" BRASS CAP STAMPED "UNION OIL COMPANY OF CALIFOR |
| MON12 | 2132792.08 | 5836099.98 | 993.18 | 0.999881134 | FOUND 3½" BRASS CAP STAMPED "UNION OIL COMPANY OF CALIFORNIA LA15 BM ELEV |
| MON13 | 2133508.45 | 5839650.74 | 1218.40 | 0.999870519 | FOUND 3½" BRASS CAP STAMPED "UNION OIL COMPANY OF CALIFORNIA LA15 BM ELEV |
| MON14 | 2137314.71 | 5843117.92 | 1072.83 | 0.999877645 | FOUND 3½" BRASS CAP STAMPED "UNION OIL COMPANY OF CALIFORNIA LA15D 1215.24" |
countyofsb.org/pwd/pwsurveyor.aspx